International Journal of Wireless Networks and Communications.
ISSN 0975-6507 Volume 7, Number 1 (2015), pp. 53-62

http://www.irphouse.com

Effective Real-Time Data Communication through ERSS

Abhinaba Ghosh
56A/28 Putiary Banerjee Para Road, Plot No.-14, First Lane, Kolkata-700041

Zeeshan Qadir
Equal contributor, 4th year students, Meghand Saha Institute of Technology (Electronics & Communication Engineering)
Kamal Residency, B/2/103, Greenpark, Kolkata-700103 West Bengal, India

Md Masud Sarkar
Nabagram, Dakshin Dinajpur-733141 West Bengal, India

Wasim Reja
Joynagar, Murshidabad-742189 West Bengal, India

Dr. Chandi Pani
Assistant Professor, Meghnad Saha Institute of Technology Flat 2B, Arunima Apartment, 197/2, Motilal Gupta Road, Kolkata-700082 West Bengal, India

Ms. Oindri Ray
Assistant professor, Meghnad Saha Institute of Technology Siddha Town, Lily 111, Rajarhat, Narayanpur, Kolkata-700156 West Bengal, India

Abstract

World is now technically advanced. For public safety and asset protection the close and critical security are the most important job for remote surveillance. New technology has begun looking to the manmade disaster. There is a need of secure remote wireless close monitoring for the unmanned places. Integrating a sensor domain with GPRS or GSM technology is more reliable technique. The integration of sensor domain with a communication domain must comply with the new technologies for significant improvement in case of remote security system. This advanced technology can provide a new area of security surveillance. It is quite obvious that all the current security system has been working with sensor domain with a communication domain. All new current remote surveillance system is designed with a centralized sensor domain along with GPRS system. But is case of absence of ISP‟s backbone the surveillance data transfer and monitoring become impossible. Areas like dense forest, frozen valleys; security prone zones a hidden secure security system in very important. This is a proposed work introduces a complete camouflaged hidden real-time monitoring of unmanned zone by ERSS wireless solution. Enhanced Remote Surveillance System (ERSS) provides a complete decentralized integrated solution between wireless sensor domains with communication domain.

Key Words: ERSS, secure data communication, wireless sensor domain

1. Introduction:

This proposal introduces a complete camouflaged hidden real-time monitoring of unmanned zone by ERSS wireless solution. This research may have tremendous impact due to its uniqueness. Enhanced Remote Surveillance System (ERSS) provides a complete distributed integrated solution between wireless sensor domains [1] and communication domain. In this proposal the surveillance is provided through real time sensing and the sensed information is going to be fetched from anywhere via communication domain [2]. In Indian scenario this type of integrated real time sensing and communication for remote zone is still in child phase due to lack of charging facility of wireless sensor nodes as well as wireless devices which are committed for transmitting information at far ends.

Security prone zone may be observed minutely and precautionary measures may be taken immediately for the sake of goodness of human being if any violent actions are observed [3, 4]. All the current remote surveillance system is based on centralized sensor domain and it is integrated with GSM or GPRS technology for transferring the data at distant end. But presently there is no suitable solution for the zones/areas where ISP‟s backbone is not available, as for example, remote moors locations like dense forest zone, frozen valleys like Leh, Ladakh or any other military security prone zone at LOC. For these places hidden remote surveillance system is much more effective.

2. Methods of Implementing ERSS

This implementation needs field surveillance solutions which are used by a wide range of applications for different departments. This remote surveillance can provide a continuous monitoring to the unmanned zone and hence provide a defense security. Different types of military operations, illegal dumping, drug fields, man-armed clustering and some types of environmental disaster can be observed and monitored through the wireless surveillance. Typically specialized transducers with enhanced communicating interface provide an infrastructure that utilizes radio for monitoring the physical conditions of the target area. The monitoring parameters may be temperature, humidity, speed, different types of vibration intensity, wind motion, or illumination intensity. Chemical parameters can also give minute detection like vital body functions, pollutant levels, etc. A real time bot surveillance system using GPRS or GSM is under research and it is having tremendous impact for its feasibility in unmanned zone and it can work without the presence of regular adapter power charging. Generally the idea of multi GPS positioning is being incorporated for the real time bot surveillance system [5, 6]; in this case GPRS can be used. In our design the step wise communication and charging gives a secure and hazard less communication domain that helps to have a continuous monitoring. There may have the facility to add a Location-based Service (LBS) for reliable and accurate position reporting in addition to rover-based positioning performance with automatic position reporting system (APRS)

This proposal consists of implementing decentralized integrated real time sensing with distant monitoring via wireless communication channels. To meet the requirement of power constraint in remote zone, our proposed model adopts two methods to maintain uninterrupted service: clustering the zone and the concept of induction charging through mobile charger. In our proposal the following steps are involved for detection and secure data transmission through wireless channels:

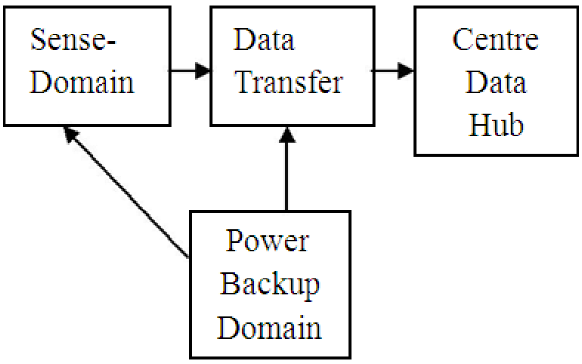

Fig. 2.1: Uninterrupted steps for ERSS method

Object-detection [5, 7] through Thermal IP cameras classify the objects and analyze the tracking behavior and the activity of the object. Accurate and secured data transmission from sensor nodes to distant monitoring station(s) [8, 9] can also be achieved with proper charging arrangement of all the sensor nodes as well as communicating devices. Our visual surveillance system works on the platform of Flash Media Server Technology. The block diagram of our proposed ERSS framework is shown in Fig. 2.1 where sensing domain consisting of several number of IP thermal camera, sending data to the data transfer network by Time

Division Multiple Access (TDMA) technology. Finally the data is send to the data center where the IP service provider‟s network is available. Hence the data can be monitored from any location to take necessary action.We can also eliminate the requirement of ISP‟s backbone if we place the monitoring office in proximity of data centre.

In this section we present the detailed working principle of our framework. Fig. 2.2 shows the detail framework of the proposed model. Here the unmanned or dense forest zone is divided into different clusters. Multiple sensors (here cameras) are placed in the corners of each cluster. Each cluster has an access point called cluster head which is responsible to take the data from sensor nodes. All cluster heads are connected to the master cluster head via wireless links. Individual cluster heads sends the data to the master cluster head. To increase the range, multiple access points can be used to frame the network as Extended Service System (ESS) model for WiFi technology. Finally it is connected to the ISP‟s backbone network.

From Fig. 2.2 we see at first the entire region is divided into different hexagonal clusters and the sensors are placed at every corner. Cluster heads (CHs) are placed at the centre of each hexagonal cell. For precautionary measure CHs are placed in such a way that each sensor [1, 10] can be accessed by two CHs. Each CH receives the data from the sensors in TDMA basis and sends the data to the Master CH (MCH). MCH also receives the data from the CHs in TDMA fashion. Fig. 2.3 describes the flow chart for the whole process

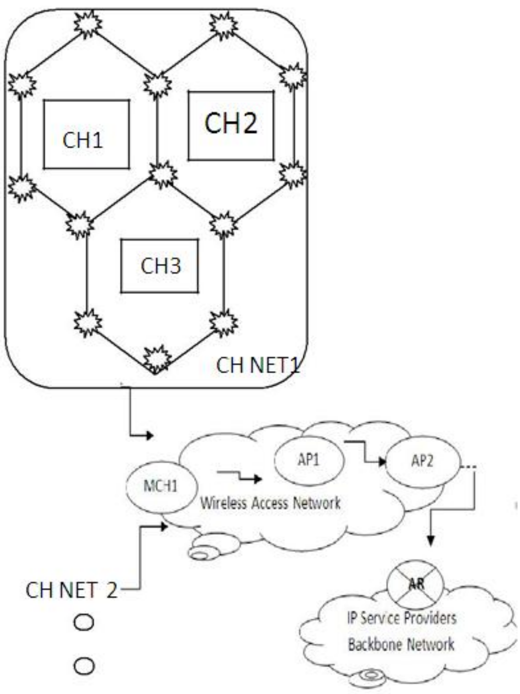

Fig. 2.2: Proposed ERSS Framework

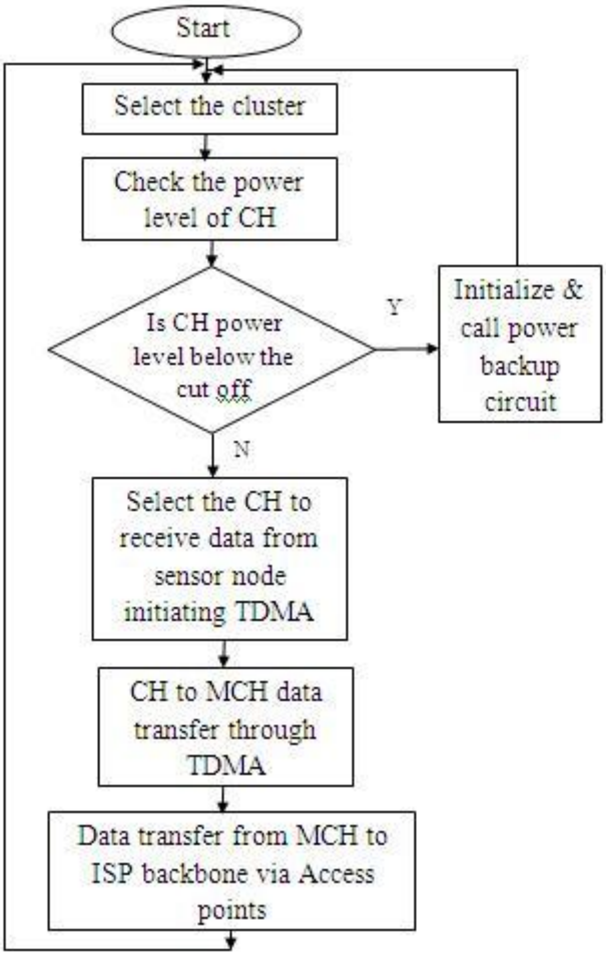

Fig. 2.3: Flowchart of the process

3. Experimental Analysis

For the experimental analysis of the ERSS system, we used two Linksys Wireless-G Broadband Routers (WRT54G v7) and wireless IP cameras for the purpose of surveillance.

(A) Experiment using single router: First the router is turned on and a connection between the camera and the router is established wirelessly using Wi-fi. Next the laptop, used for monitoring, is connected wirelessly to the router. The IP address of the camera is manually entered and configured with the laptop to receive the real time data. Depending on the signal strength of the router (here we used 2.4 GHz router) more than one camera can be connected to the system.

(B) Experiment using two routers: First, the two routers are configured internally as sender and receiver using a CAT 6 Ethernet cable to link the two routers. The cameras are connected to one router (CH) while the other router (MCH) is connected to laptop for monitoring.

Table 3.1: Variation of total transmission range with variations in number of routers and input cameras.

No. of routers	No. of Cameras	Total Transmission Range (in ft.)
1	1	165
1	2	120
2	1	225
2	2	190

The main purpose of configuring more routers to the system (either wired or wireless) is to enhance the range of the system for real time data transmission as implied from Table 3.1.

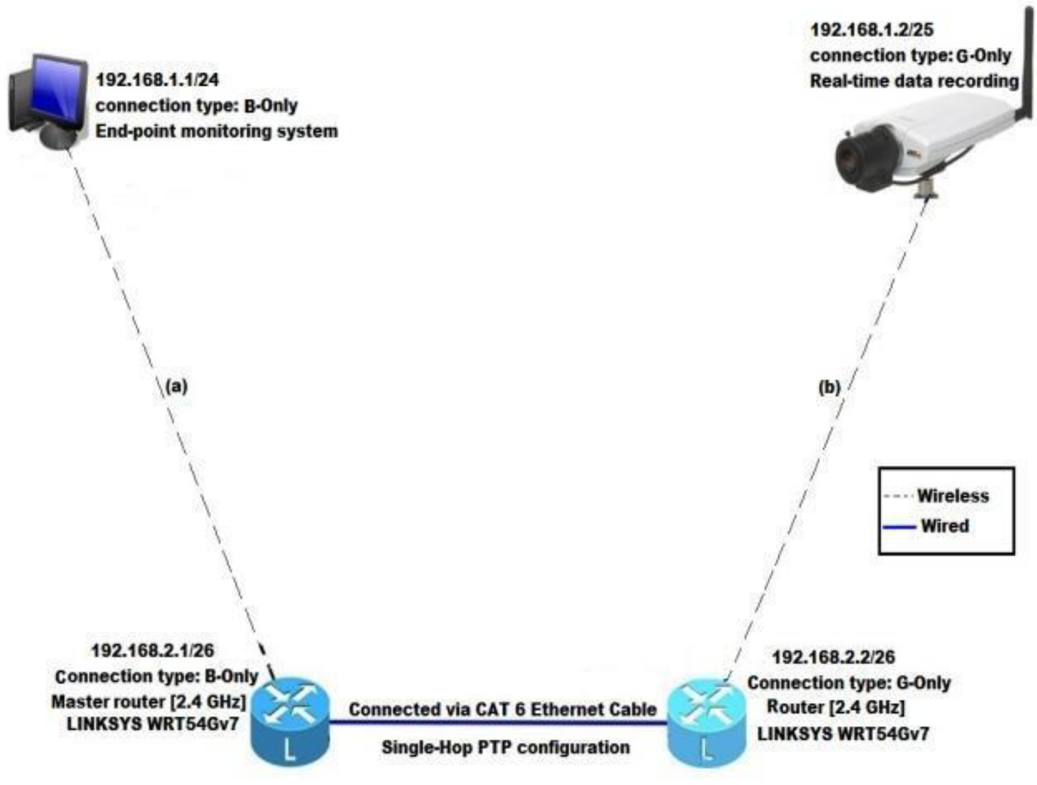

Fig. 3.1: Experimental setup with (a) 100 ft. and (b) 120 ft. distance apart

4. Experimental Results

Signal Strength under no load

In order to measure the signal strength under no load, i.e., without any transmission path, we simply measure the router signal strength at different distances. In order to achieve this we used Wifi Analyzer, an Android based application, the readings of which are shown in Table 4.1 and Fig. 4.1.

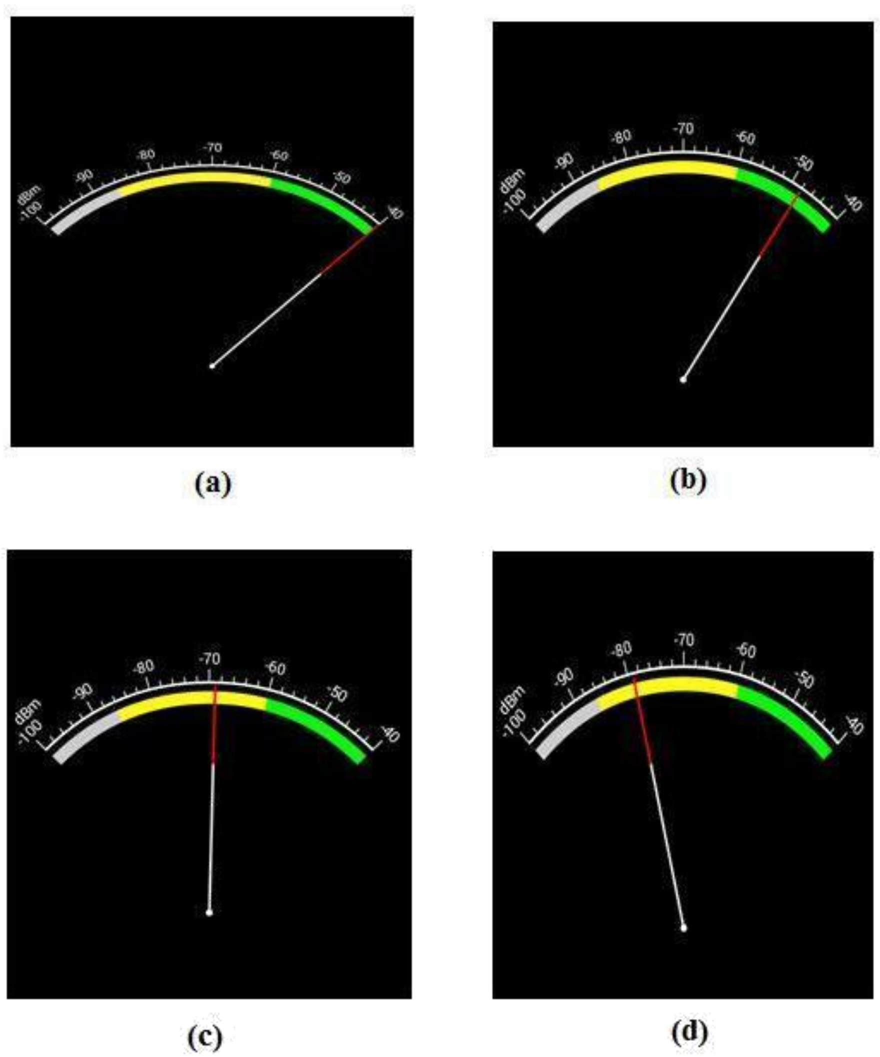

Fig. 4.1: Signal strength under no load condition when measured (a) 0 ft., (b) 25 ft., (c) 75 ft., and (d) 100 ft. apart from the transmission point.

<u>Signal Strength with load</u>

In order to measure signal strength under data transmission, the cameras are connected wirelessly to the routers sending real-time data which is monitored on the other end. The readings of the Wifi Analyzer under data transmission at different distances are shown below in Table 4.1 and also in Fig. 4.2.

Table 4.1: Signal strength of the router w.r.t distance from it under load and no load condition

Distance (in ft.)	Signal Strength (in dbm)	
	Without Load	With Load
0	0	0
25	-46	-51
50	-56	-60
75	-70	-72
100	-76	-81
125	-84	-90
150	-90	-90

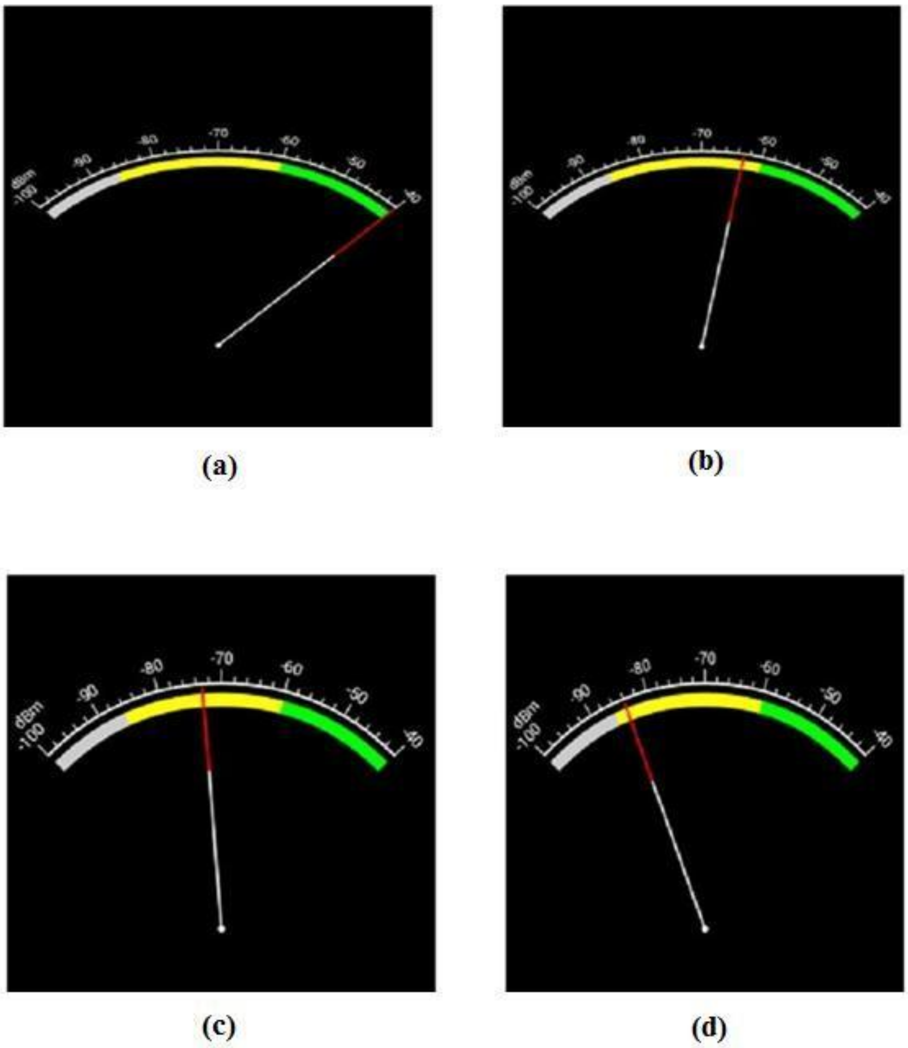

Fig. 4.2: Signal strength under load when measured (a) 0 ft., (b) 50 ft., (c) 75 ft., and (d) 100 ft. Apart from the transmission point

The data in Table 4.1 is plotted in a signal strength v/s distance graph as shown in Fig. 4.3. It can also be observed that as the load increases the signal strength decreases.

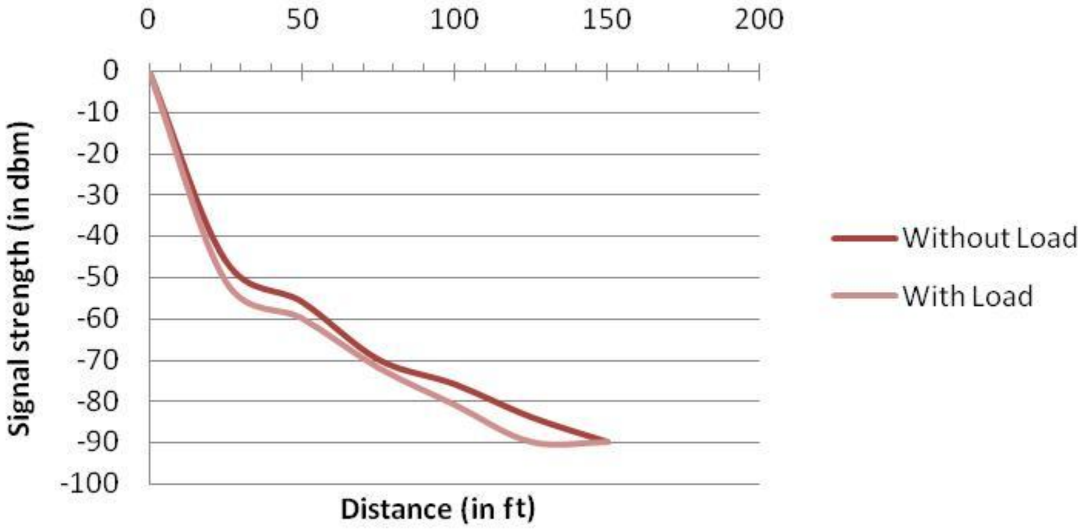

Fig. 4.3: Distance v/s Signal Strength of the router

5. Conclusion

Enhanced Remote Surveillance System (ERSS) provides effective and accurate real time data transmission through a closed wireless communication system in an abundant area where resources like base station or satellite communication system seems faulty. The above proposed system accepts this challenge and provides a backbone for real-time data communication through secured wireless transmission system. Further modifications like X-ray cameras or thermal imaging cameras can be implemented into the system with enhanced modern long-range routers for larger distance surveillance and detailed imagery.

6. References

[1] Ronetti, N., and C. Dambra: „Railway station surveillance: the Italian case", in Foresti, G.L., P. Mahonen, and C. S. Regazzoni (Eds.): „Multimedia Video Based Surveillance Systems" (Kluwer Academic Publishers, Boston, 2000), pp. 13–20

[2] Khan, Atif Ali and Muneeb Iqbal: „A Motion Detection based surveillance systems (MDSS)", First International conference on Informatics and computational Intelligence, IEEE, 2011.

[3] Alan, J. L., H. H. Craig, H. Niels, and M. Donald: „Critical Asset Protection, Perimeter Monitoring, and Threat Detection Using Automated Video Surveillance", Object Video White Paper, 2004.

[4] Avis, P.: „Surveillance and Canadian maritime domestic security‟, Canada. Military J., 2003, pp. 9–15

[5] Paulidis, I., and V. Morellas: „Two examples of indoor and outdoor surveillance systems‟, in Remagnino, P., G.A. Jones, N. Paragios, N., and C. S. Regazzoni (Eds.):„Video-based Surveillance Systems‟ (Kluwer Academic Publishers, Boston, 2002), pp. 39–51 ADVISOR specification documents (internal classification 2001)

[6] Marchesotti, L., A. Messina, L. Marcenaro, and C. S. Regazzoni: „A cooperative multisensor system for face detection in video surveillance applications‟, Acta Automatica Sinica, 2003, 29, (3), pp. 423–433

[7] Ping Lai Lo, B., J. Sun, and S. A. Velastin: „Fusing visual and audio information in a distributed intelligent surveillance system for public transport systems‟, Acta Automatica Sinica, 2003, 29, (3), pp. 393–407

[8] Alan, J. L., H. H. Craig, H. Niels, and M. Donald: „Critical Asset Protection, Perimeter Monitoring, and Threat Detection Using Automated Video Surveillance‟, Object Video White Paper, 2004.

[9] Fang, Zhang, Yunhong Wang, and Zhaoxiang Zhang: "View-invariant Action Recognition in Surveillance Videos", Proceedings of IEEE, 2011.

[10] Nguyen, N.T., S. Venkatesh, G. West, and H. H. Bui: „Multiple camera coordination in a surveillance system‟, Acta Automatica Sinica, 2003, 29, (3), pp. 408– 421